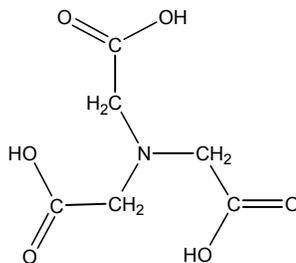


**NITRILOTRIACETIC ACID**  
**CAS No. 139-13-9**  
First Listed in the *Third Annual Report on Carcinogens*



## CARCINOGENICITY

Nitrilotriacetic acid is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (NCI 1977, Goyer *et al.* 1981, IARC 1990, 1999). When administered in the diet, nitrilotriacetic acid induced kidney tubular cell adenocarcinomas in mice of both sexes, kidney tubular cell adenocarcinomas or adenomas in male rats, papillomas or adenomas of the ureter in male rats, and transitional cell carcinomas of the urinary bladder in female rats. Increased incidences of pheochromocytomas of the adrenal gland and hepatocellular adenomas were also observed in female rats.

No adequate human studies of the relationship between exposure to nitrilotriacetic acid and human cancer have been reported (IARC 1999).

## PROPERTIES

Nitrilotriacetic acid is a combustible, white crystalline powder that is slightly soluble in water, soluble in ethanol, and insoluble in most organic solvents. The compound forms mono-, di-, and tribasic salts that are soluble in water and also forms water-soluble complexes with many metal ions. When heated to decomposition ( $\geq 246^{\circ}\text{C}$ ), nitrilotriacetic acid emits toxic fumes of carbon monoxide, carbon dioxide, and nitrogen oxides. This compound is incompatible with strong oxidizers, aluminum, copper, copper alloy, nickel and strong bases (IARC 1990, 1999, NTP 2001).

## USE

Nitrilotriacetic acid has many commercial applications, but it is used primarily as a chelating agent and as a laundry detergent builder. The compound sequesters magnesium and calcium ions present in hard water, thereby reducing buildup and scaling caused by salts of these ions (IARC 1990). In the late 1960s, nitrilotriacetic acid generally replaced phosphates in commercial detergents (NCI 1977). Although its use in detergents was suspended in the U.S. in 1971, this use resumed in the 1980s after phosphates were banned from detergents. It is used as an eluting agent in purification of rare-earth elements, as a boiler feedwater additive, in water and textile treatment, in metal plating and cleaning, and in pulp and paper processing (IARC 1990, HSDB 2001). To a lesser extent, the compound is used in leather tanning, photographic development, synthetic rubber production, the manufacture of pharmaceuticals, and in herbicide formulations and micronutrient solutions in agriculture (NCI 1977, Sax 1987).

## PRODUCTION

There is at least one current U.S. manufacturer (HSDB 2001) and 24 U.S. suppliers (Chem Sources 2001) for nitrilotriacetic acid. Nitrilotriacetic acid was first synthesized in 1862 and commercial production began in Europe in the 1930s. The TSCA Inventory (1979) reported that one company produced an unspecified volume of nitrilotriacetic acid, and two companies imported 55,000 lb in 1977. The TSCA Inventory also reported that three companies produced 75 million lb of the trisodium salt of nitrilotriacetic acid, and one company imported 500 lb in 1977. In 1970, the year before the use of nitrilotriacetic acid in detergents was suspended, the United States produced 150 million lb and used 86% to 92% in detergents (NCI 1977). The EPA (1979) estimated that 70 million to 75 million lb of nitrilotriacetic acid were produced in the United States, and 60 million to 65 million lb were exported. In the early 1980s, most of the annual U.S. production (approximately 30,000 metric tons or 66 million lb) was exported (IARC 1990).

## EXPOSURE

The primary routes of potential human exposure to nitrilotriacetic acid are inhalation, ingestion, and dermal contact. Potential occupational exposure occurs through inhalation and dermal contact during the manufacture of the compound or its salts, during water treatment, and during other production procedures in which the compound is used. The general population may be exposed through ingestion of drinking water or dermal contact with products containing this chemical or its salts (HSDB 2001).

The National Occupational Hazard Survey, conducted by NIOSH from 1972 to 1974, estimated that 14,600 workers were possibly exposed to nitrilotriacetic acid, trisodium salt in the workplace in 1970 (NIOSH 1976). The National Occupational Exposure Survey (1981-1983) estimated that approximately 11,700 workers potentially were exposed to nitrilotriacetic acid, but approximately 270,000 workers were potentially exposed to nitrilotriacetic acid and its trisodium salt (IARC 1999, HSDB 2001). In 1990, approximately 2,600 workers were potentially exposed to nitrilotriacetic acid salts during production and detergent formulation. Workers loading hopper cars had the highest potential exposure (IARC 1990).

Major exposure assessments were conducted for nitrilotriacetic acid in the U.S. in 1979, 1980, and 1985. Canada conducted an exposure assessment in 1996. All of these studies concluded that the total daily exposure to consumers from all sources was <1 µg/kg body weight per day. These surveys included exposure from drinking water, bathing, clothing washed with detergents containing nitrilotriacetic acid, inhalation, skin contact with washwater, and incidental ingestion of residues remaining on hand-washed dishes (IARC 1999).

EPA's Toxic Chemical Release Inventory (TRI) listed 16 industrial facilities that released 12,950 lb of nitrilotriacetic acid in 1988. In 1999, only three facilities reported releases of 8,520 lb of this chemical. However, total annual releases to the environment from 1988 to 1999 ranged from a low of 1,588 lb in 1996 to a high of 14,009 lb in 1998 (TRI99 2001).

## REGULATIONS

EPA regulates nitrilotriacetic acid under the Superfund Amendments and Reauthorization Act (SARA), subjecting it to reporting requirements. Under the Toxic Substances Control Act (TSCA), EPA included some caveats as recommendations to manufacturers and processors of nitrilotriacetic acid, even though EPA determined that exposure of adults to the compound was

low (1 µg/kg per day). Under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), nitrilotriacetic acid can be used as an ingredient in sow shampoo and may also be used to disinfect swine quarters. There are no tolerances or tolerance exemptions.

FDA regulates trisodium nitrilotriacetic acid as a secondary direct food additive, that is, as a substance added to food during preparation or handling, and subsequently removed before the food is ready for consumption. FDA limits trisodium nitrilotriacetic acid added to boiler feed-water to 5 ppm.

OSHA regulates nitrilotriacetic acid under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table 119.

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**Nitilotriacetic Acid (Continued)**

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